Personality Templates and Social Hierarchies Using Stereotypes

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Abstract. In order for interactive agents to be believable, they will need to respond to any likely situation in a manner that is consistent with their personality, as well as their position within social hierarchies. Thus believable agents will need to have a clearly defined personality, social role, and other traits that will govern their actions in a virtual world. The goal of this paper is to present a template that can be used to define such traits of a character in order to maintain consistency. The template will be dominated by a model that defines aspects of personality typically used to define persons across cultures, aiding both intuitive creation by authors, and acceptance by users. It will also be able to take advantage of character stereotypes to ease the authoring process. In addition to this, a social hierarchy framework is given.

Key words: interactive drama, synthetic characters, personality, social-hierarchy, stereotypes

1 Introduction

Over the past few decades there has been a great deal of work toward creating believable agents in computer-generated works, both static and interactive. Previous works have used static templates with a set of traits to give agents a consistent foundation on which to base their behavior [9] [6]. A template specifies a set of traits important to defining an agent's character, such as personality and knowledge areas. This paper presents a templating system which defines a set of traits for a synthetic character template, a social hierarchy model that templates tie into, and how stereotype templates will be utilized. This system sets itself apart from prior work in that the choice of personality traits have a strong psychological motivation. Further it allows for complex social hierarchies by using a directed acyclic graph as a model rather than the simplistic linear power scales of previous work. This template system is intended to ease character creation by structuring the process, and directing synthetic character authors toward key aspects of character.

One aspect necessary for making characters believable is giving them realistic personalities. Previous works [9] [6] have included a set of personality traits in

their templates, but little motivation is given for their choice of traits. The personality traits used in this template differ in that they are motivated by a strong psychological model.

To be believable, synthetic characters must also use social roles and the hierarchies associated with them to guide their interactions as people do. Prior work has looked at this, but it has been relatively simplistic, assuming a single linear hierarchy[11] . Here a more complex hierarchy that more accurately models real world hierarchies is specified, which can be utilized by the character templates

Conforming synthetic characters to a set of stereotypes can also aid believability. Stereotypes are also used by people to categorize others, helping them limit the complexity level at which they view their world. Because of this, it is believed that by placing characters into stereotypes, users will have an easier time accepting them. Further, it simplifies the character author's task, allowing characters to be quickly defined in a broad sense, so that the author can give more attention to the unique points of a character. Stereotypes are also useful for systems like OPIATE [5] which places characters into predefined roles. "Stereotype" in this sense should not carry the connotation of prejudice. Rather it defines a set of traits that could realistically be expected of a person given their social role, or background.

There are several criteria that should be met by a character template that will ease the creation of believable agents. First, it should *facilitate the creation of consistent and coherent characters* [9]. If both the inherent properties of agents and their world, are not subject to drastic changes, without some reasonable cause, consistency is maintained. Coherence is maintained if there is a logical explanation for events in the world given the information available to the user. If an agent takes some action, it should make sense in light of its history, personality, emotions, etc.

A broader criteria is that the template should *model reality as closely as is practical*. For instance if the template takes into account social relationships between agents, it should be able to model all probable relationships. In regard to personality, the template should be able to represent all aspects of personality, or at least those aspects that are necessary to govern observable behavior.

The template should also *strive for universality*. Keeping the template free of any chauvinism towards a gender or cultural group will likely result in a template that focuses on the core aspects of character.

As this template is intended to be used in character creation, the *correspondence between what is defined in a template and how it is manifested in characters should be apparent to authors*. One aspect of this is that what is in the template should have a clear connection to a real world counterpart.

In the following section, previous work in this area is discussed in more depth. In section 3 the template framework is discussed in detail, with a short example of defining a character with the framework following in section 4. Section 5 describes future work that will be needed to utilize and test the effectiveness of the framework, with a conclusion in section 6.

2 Related Work

2.1 Character Templates

There have been prior attempts to create a standard template to be used in defining synthetic characters. Most notably are the "person frames" detailed in [9]. Lebowitz's "person frame" template for the UNIVERSE system was designed in order to maintain consistency and coherence in the story-telling world. That is if an agent takes some action, it should make sense in light of its history, personality, emotions, etc.

In order to maintain consistency and coherence, Lebowitz specifies information from three categories in his "person frames": personality traits, interpersonal relationships, and goals. His set of personality traits include information such as age, sex, intelligence, guile, niceness, and other such broadly defined aspects of personality. In order to simplify the assignment of these traits, UNIVERSE uses stereotypes to provide default trait values. These stereotypes include traits associated with occupations, social groups, or backgrounds.

Goldberg also defined a similar template for personality traits focused on use for character animation [6]. Like UNIVERSE's "person frames" it defined traits that govern how physical activities would be performed, such as strength and coordination, as well as traits that govern interactions with other characters, such as amiability and intelligence. Along with these very general traits, very specific traits relating to a single task, character, or knowledge area can also be specified. These traits are used to give specifics to such broadly defined traits as *intelligent* or *strong.*

2.2 Stereotyping

It has been mentioned that stereotyping will aid authors in creating believable agents. Agents that conform to stereotypes will also be easier for users to size up. Rich states that:

> [P]eople use stereotypes as a means for dealing with the fact that the world is far more complex than they can deal with without some form of simplification and categorization. One of the ways in which stereotypes help to simplify the world is that they have a strong effect on what characteristics of a person are attended to and remembered. As a result, they will tend to be confined by experience since potentially disconfirmatory evidence will be ignored [12].

Though Rich's [12] system applied stereotypes to users, he gives evidence that users will attempt to stereotype agents. Thus by creating agents that conform to a stereotype, authors can take advantage of conventions already used by users, perhaps even with the advantage that some errors that could detract from believability will be overlooked.

Both Rich [12] and Kobsa [8] point out that one person will need to fall into multiple stereotypes so as to flesh out all of their traits. This leads to conflicting

traits that need to be resolved by selecting the one that is more fitting. Both also recognize the need for more specific subgroups within a stereotype. Rich uses a directed acyclic graph (DAG) with a partial ordering relation of "generalization of" for the stereotypes. For example, at the top of the graph would be *any-person*, which may have a child *teacher*, which may have a child *high-school-math-teacher*, and so on.

2.3   Personality

Prior use of templates to define agents has assumed that personality or psychological traits are the best means of creating such a definition. Rousseau & Hayes-Roth based their look at personality in synthetic agents on psychological trait theories[13]. In their work the claim is made that psychological traits (lazy, confident, friendly, etc.) are commonly used to describe people and are psychologically adequate to define the traits that influence a person's behavior. These traits are assumed to dispose people to exhibit consistent behavior across different situations, agreeing with Lebowitz's [9] requirement of coherence across an agent's actions.

Table 1. Factors and Facets of the Five-Factor Model

Factor	Facets
Neuroticism	Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness, Vulnerability
Extroversion	Warmth, Gregariousness, Assertiveness, Activity, Excitement-Seeking, Positive Emotions
Openness	Fantasy, Aesthetics, Feelings, Actions, Ideas, Values
Agreeableness	Trust, Straightforwardness, Altruism, Compliance, Modesty, Tender-mindedness
Conscientiousness	Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, Deliberation

Though it is held that traits are adequate to describe personality, what set of traits covers the full range of personality has been left open. One model of describing personality that is widely accepted by psychologists is the five-factor model (FFM). Evidence indicates the FFM is sufficient for describing the full range of personality. In tests where people were asked to describe themselves given a large list of adjectives, people tended to choose five, and rarely more than six [4]. Further, the adjectives selected repeatedly fell into the same five categories (see Table 1). Personalities tend to be very stable, having few changes over the years, and personality profiles using the FFM reflect this [4]. More importantly the FFM is found to be free of chauvinism. Both males and females can be described by the FFM. McCrae & Costa shows research indicating that the FFM is also universal across cultures, though there may be differences in what is perceived as the norm, or in how different traits are expressed[10].

2.4   Social Roles

Agent awareness of social roles is another important factor in achieving believability. Prendinger & Ishizuka [11] have observed that synthetic agents do not modify their behavior with regard to their and others' social roles, and the social setting they find themselves in. Yet humans do this with ease, and thus so must believable agents. One of the key aspects of social roles are power levels. An example of how power levels are important to agent behavior is given by Prendinger & Ishizuka where a secretary brushes off an aspirant's request to make copies but complies when a manager makes the same request. The two different responses are believable because of the difference in power level relative to the secretary. Prendinger & Ishizuka suggest modeling these power levels with a linear power scale, with each agent having a different place along the scale. However this ignores the fact that a manager's high power level may be meaningless at another company, or even in another department within the company. Thus the situation or setting is also a key aspect of social roles.

3   Template Framework

In the following section a template is given for defining a character's personality, physical, and other traits. A set of stereotype templates and a social hierarchy that work with the character templates is also described.

3.1   Consistency & Coherence

The first aspect of this template is that it will primarily focus on things that are unchanging about a character. Lebowitz [9] makes a case for the importance of consistency and coherence. By focusing on those aspects that are static, a good foundation will be provided for character creation. This stability is expected to make characters more believable, as Digman [4] points out, people's personalities change very little over time. That is not to say that it is expected that an agent's template will remain unchanged throughout the course of their virtual life, but that there should be a strong basis for change in order to maintain believability.

3.2   Traits

The core of the whole template is the list of traits. Personality underlies much of the behavior of an agent. Though agent's goals, social roles, and emotions play an important part as well, these really only refine how the personality is exhibited. Physical traits are more important to how other agents and users view an agent. Traits concerning appearance cannot be left only to art directors as there must be a representation that is understandable by other agents. Along with these traits, more unique traits, such as specific skills or knowledge areas, can be defined. These, along with some physical traits, will govern what characters are capable of knowing.

Personality Traits The different areas selected for defining personality in previous works were chosen without any backing motivation. The result of this is that the selected set of traits may not cover the full range of personalities, and can overlap with each other. To avoid these issues the five-factor model for personalities is utilized as it has been shown to cover the full range of personalities, is universal, and, most importantly, is made up of terms actually used by people to describe personality [4][10]. Though it is not known whether the FFM truly cover the depth and range of the core of personalities, it is adequate for both the average person's and the psychologist's description of personality. Thus it is a well suited guide for character designers in defining personalities.

The five-factors of personality are listed in Table 1. One shortcoming of this list is while there is strong agreement on the number of factors, there is not a strong consensus as to their meaning[4] . Even for traits like extroversion, whose meaning seem apparent, it may be difficult to pin down exactly how extroverted behavior should be exhibited. Still, the evidence that this model is well suited to describing personalities is strong, which is the purpose of the template defined in this paper. The burden of how the personalities play out falls within the domain of programmatic implementations.

Fortunately some of the ambiguity is cleared up in the NEO Personality Inventory, which splits each factor into six facets (an example report is seen in [2]). Agreeableness, for example, has facets such as trust, altruism, and modesty (Table 1). These facets make it clearer which aspects of personality agreeableness dictates, and from an author's perspective allow finer control of character design. For this reason, the personality definition will consist of both the five factors, and their more specific facets.

Explicitly, the personality definition will consist of 30 facets, split into five groups of six. Each group has a parent that is one of the factors of the FFM. Any facet that is left unspecified will inherit its value from its parent factor.

Physical and other Traits The physical traits require a little less forethought, as they are more obvious. However, as stated, it is necessary to describe all physical traits that affect how an agent interacts with the world, and with how other agents view them. Some example traits are *name, sex, weight, age, height, hair color, hair style, voice, clothing style,* etc. Though *clothing style,* and *hair style* may not fit the focus on aspects that are more static, it would be likely that a character's style choices (suits, trendy, utilitarian) would largely be static even though the clothes choices may not. The associated value type for a given trait is dictated by what that trait represents. *Height* and *age* would have real world units. *clothing style* will use descriptive terms dictated by the agents world.

Unique Traits Unique traits include anything that does not fit into previous trait categories; the things that may not be necessary for every agent, or desired by every author. These include things like skill sets (expert sailor, average pool player), and knowledge areas (expert on Egyptology, novice of celebrity trivia). This specificity is necessary as general traits like *intelligent* mean little when a

character does not have that intelligence applied to specific areas, and a character that has high intelligence in all areas would be unbelievable. Both the traits, and their values are author defined, with the expectation that things like knowledge areas will tie into a related database containing the knowledge. Thus the scale that defines the level of skill or knowledge should be such that it fits with the related database, and will not be specified here.

3.3 Stereotypes

Stereotypes will be used to ease the creation of synthetic characters. Stereotypes provide default values for character templates based on what is expected of their social role, or background. For instance a construction worker would be expected to be skilled with tools and physically fit. A college graduate would be expected to have knowledge in certain areas. By having a set of stereotypes, an author can select one for a character to fill in some basic information, with the author needing only to tweak some values to make the character unique. Along with aiding author creation, stereotypes will help conform agents to user expectations. It is known people use social roles to categorize people [7], and that these stereotype categories make it easier for people to deal with information in the world [12]. As long as the observed stereotype fits with the user's expectations, they can help users quickly appraise an agent, making them more believable to the users.

Though it may be acceptable for peripheral characters to only fall into one stereotype, when a major character is so tightly pigeon-holed they will likely appear, and in reality be, one-dimensional. As Rich [12] and Kobsa [8] suggest, characters should have multiple overlapping stereotypes. Dahlgren [3] indicate that richness, vividness, and distinction arise in characters when given multiple stereotypes.

One difficulty of combining stereotypes is deciding which stereotype wins out when two traits conflict. Automatic resolution of conflicting traits will not be addressed in this paper as it is expected authors will not choose multiple stereotypes with a large number of conflicting traits. Thus resolving conflicts by hand should be manageable.

These stereotypes, following Rich's [12] model, will fall into a DAG with a single root stereotype, *any-person* (Fig. 1). Each stereotype will inherit trait values from its parents, and specify certain trait values in which it differs and overrides its parent's values. Stereotypes will be painted with broad strokes when high within the graph, and gain specificity deeper within the graph. An example path down the stereotype graph could go from *any-person*, to *medical-professional*, to *doctor*, to *pediatrician*. Having multiple parents is also acceptable, as if a stereotype was given for a doctor at St. Jude's, it would be desired to have it inherit traits from *pediatrician* and *oncologist*.

The root stereotype, *any-person*, will likely be a challenge to define. Even something as simple as height will have to take into account cultural considerations to choose the norm. Some aspects of the norm may be best left to authors so they can select defaults suitable for their virtual world.
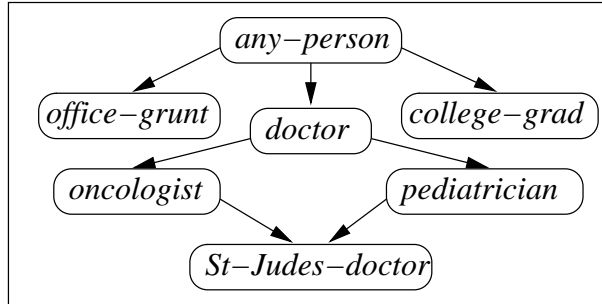
Fig. 1. Sparse Stereotype DAG

3.4 Social Hierarchies

Prendinger & Ishizuka [11] give evidence to the importance of social roles and the power levels associated with them. Certainly if someone knows that someone else has control over their job or freedom, they will treat that person differently than if there were no power differential, or if the differential were reversed. Yet the application of social roles can be rather complex as they are situational and cannot be defined by a rigid power scale. For example, a bartender has a higher power level than the average person when at his bar, but not when on the street (yet if the man on the street is also a patron of his bar, the social relationship may still influence interactions). A proper model of social hierarchies will need to take this scope into account.

Prendinger & Ishizuka [11] suggests indicating power levels with a linear power scale. However power levels are not universal. A CEO does not have authority over employees in every company, and a manager does not have authority over every department. Having one universal power scale will create very unrealistic interactions between agents.

To handle these complex relations a directed graph that includes scope indicators will be used (Fig. 2). The graph can be separated into several sub-graphs, allowing for certain power relationships to have no meaning against others. Each node in the graph will have a title (i.e. "store manager") that can be referenced from an agent template or stereotype. Each node can have multiple scopes, one for each edge. The scopes dictate in what context the power relation is relevant (i.e. for the "store manger" it is in the store). It is imaginable that authority roles may change with situations. For instance a manager would typically have authority over someone in tech support, but if there is a virus outbreak in the office their relationship could be temporarily reversed.

3.5 Unspecified

A few notes on things that are not specified by this template: relationships, emotions, the nature of social hierarchy relationships, and gender differences.
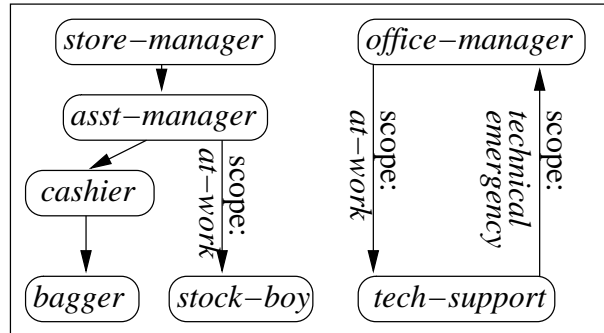
Fig. 2. Two Disconnected Social Hierarchies

Relationships Marriages, friendships, feuds, and other such relationships are no doubt important aspects of characters. If an agent does not act appropriately in regard to their relationships it will cause confusion. However, we believe that which relationships occur between people are affected by their personalities and social roles. Thus the relationships can be generated after an agent's profile is created and should be separate from this template. In fact, Lebowitz [9], who did a great deal of work on designating agent relationships did something similar by simulating "past lives."

Emotions Bates [1] states that "If the character does not react emotionally to events, if it does not care, then neither will we." Emotion is not only important for believability, but also for the level of user engagement. Yet emotions change quickly while this project's intent was to focus on the static aspects of characters. Further, emotional responses are dictated greatly by personality. Thus this work provides a good foundation for an emotional system to work with.

Nature of Social Hierarchy Relationships It may appear that the particular nature of the social relationships are not conveyed by this system. Can it differentiate between an evil tyrant's relationship with their subjects and a sweet mother's relationship with her children? Though not specified by the hierarchy, these differences will arise out of the agents involved in the relationship i.e. a benevolent relationship would have an altruistic ruler.

Gender Differences One area that may need more attention is that of gender differences. In the interest of maintaining a relatively narrow view, gender was for the most part ignored.

4   Example

In this section a character, Doug, will be specified. Doug is a *cardiologist*, so this will be one stereotype assigned to him. From this he inherits the unique

trait *expert-knowledge: cardiology*. In this virtual world cardiologists are fairly straightforward, so he also inherits a *straightforwardness* (an *agreeableness* facet) of 0.75. It is expected cardiologists have to spend a good deal of time in medical school, and have practiced for several years, so he inherits an age of *40*. *Cardiologist* is a sub-stereotype of *doctor*, so traits are also inherited from this. Doctors are very straightforward in this world, having a value of 0.9, but this is not inherited as this trait is already specified by the more specific sub-stereotype. Doctors also have a high level of *conscientiousness*, 0.8. Since this is not specified for cardiologists, it is inherited. This is the same value used for all the facets of *conscientiousness* (*competence, dutifulness, self-discipline . . .*) as they are not specified. The unique traits of *high-knowledge: biology* and *high-knowledge: medical-procedures* are also inherited.

The next level above *doctor* is *any-person*, from which Doug inherits all personality traits not otherwise specified. He also inherits the average *height, weight*, etc. for this world. So far Doug is rather bland, so we also assign him the stereotype of *Bostonian* to give him more character and some background. From this he inherits *Boston-accent* in regards to his voice, and *high-knowledge: Boston-area*.
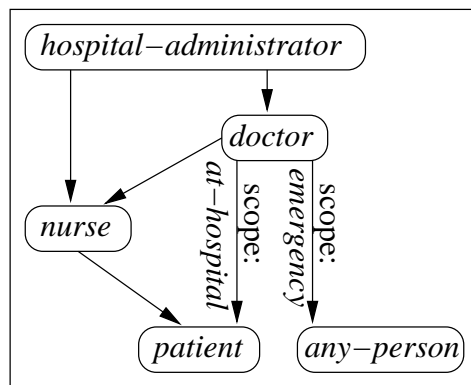

Fig. 3. Example Hierarchy

Along with the stereotype of *doctor* comes the social role of *doctor* (note: using the same name is not necessary). This can be used to reference Doug's position in the social hierarchy. As a *doctor*, Doug must answer to *hospital administrators*, and has authority over *nurses* and *patients* (Fig. 3). All of these relations have a scope of *at-hospital-of-employment*. The author can define his hospital of employment directly in Doug's profile by giving his social role of *doctor* the trait of *at-city-hospital*. As a *doctor*, Doug also has an elevated social role in regards to *any-person* in the scope of *emergency*.

Once the author has assigned Doug a number of stereotypes to fill in most of his personality, they can start tweaking some more of the details to make him

more unique. Say Doug is a cardiologist on a prime-time medical drama, so he is given high impulsiveness, and low warmth. His hair color is blond, his eye color blue, and is of a gaunt build, and so on.

5   Discussion

In this paper a framework for specifying character traits was proposed. The framework provides a template for defining a character's personality, physical and other non-personality traits, as well as placing them within a social hierarchy. The personality template differs from previous work in that the traits are based on the five-factor model, a widely accepted set of factors and facets for describing personality. Evidence that people's natural descriptions of personality conform to the five-factor model indicate that it will be well-suited to aid designers in defining personalities, and guiding them towards characters that will meet user's expectations for believable agents.

Previous work has been seen to implement social hierarchies, however they have been limited to power differentials. In this approach the context in which the social hierarchy is relevant is taken into account. This is closer to how hierarchies manifest themselves in the real world, and is expected to give believable results in the virtual world.

The template meets the requirement of facilitating the creation of consistent and coherent agents by focusing the character definition process on static aspects of character. An adequate job has been done to keep the template in-line with reality. The social hierarchy takes into account more aspects of real world social relationships than has been in the past. The FFM uses a set of personality terms that are adequate for psychologists to describe personality. The FFM model also meets with the requirement for universality of the template. As people naturally use the FFM to describe personality, this partly meets the criteria of the template having a clear connection to its eventual manifestation. Yet precisely how trait values map to personality is still vague.

Given this template the bulk of an author's work lies in filling out trait values, and creating hierarchies. If a set of stereotypes is defined authors will be able to quickly define new characters, with prominent characters requiring more effort to make them unique. This speed of character creation is a significant advantage of a template system. Though defining a set of stereotypes is in itself a daunting task, once it has been defined it can be reused.

6   Future Work

The basic framework for the template system has now been presented, but remains to be implemented. A skeleton template will be defined in XML. This will then be connected to a DAG defined for the social hierarchy. Once these two basic building blocks are created, much work will need to go into creating a default set of stereotypes and social hierarchy. It is expected this will be time consuming

and perhaps difficult. As Isbister & Hayes-Roth [7] found, expected stereotypes do not necessarily meet with what is found by psychological codifications.

The next important task is making all of these traits come to life. There needs to be a programmatic implementation that translates trait values into behavior for synthetic agent. Some questions that will need to be looked at are "what is the behavioral difference between an *extroversion* 0.5 and 0.6?" and "how should the social hierarchy be consider between two friends versus two acquaintances?" .Once this is completed, this work will be integrated with a storytelling system, and evaluated.

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